**OPTI 424A/524A. Optical Systems Engineering (4 units) Spring.** There are three main goals for 524. The first is to provide students an opportunity to synthesize the material they have learned in other classes. In other words, help students understand how to solve problems that use first order optics, radiometry, physical optics, lens design, statistics, etc. The second goal is to teach students about systems engineering. The focus is on understanding the customer’s problem, performing a functional decomposition and turning this into a requirements document. The third goal is to give students practical experience in building functional hardware where the solution is not known a priori.

Offered as graduate and undergraduate

Class meets for three 50 min sessions per week with additional time for team meetings to be scheduled.

**Grading:**
Students will be assigned teams for each case study. Grading is based on the requirements written by each team. If the requirements would solve the customer’s problem, and the hardware that is built meets all of the requirements, the team gets an A. If either of these do not happen, the team must say what went wrong, why, and what they would do differently to earn an A.

Graduate students will work on three case studies during the semester

If there are four or more undergraduates, they will be placed on the same team(s). Undergraduates will work on two case studies during the semester. Undergraduates are welcome in the class if there are three or fewer, but they will have to be mixed in with the graduate students, and, therefore, work on three case studies.

**Prerequisites:** This course is intended for students who have completed 3 semesters or more of optics studies. To complete the case studies, the teams will need to understand the basics of 1st order optics, radiometry, physical optics, aberration theory, detectors, lens design, lab practices and metrology. Students that have been exposed to three or more of these topics or are willing to learn outside of class should have the required knowledge. In addition, many of the case studies will require a basic knowledge of a lens design code, CAD software, Matlab or LabView.

**Topics to be covered**

**Systems Engineering fundamentals**
- Defining the statement of the problem
- Functional decomposition
- Establishing requirements
- Systematic design, applied to requirements
- Risk management
- Quality control, reliability
Optical system design
   1st order architecture studies
   Creative design
   Trade studies
   Detailed design and analysis
   Tolerancing
   Integration and testing

Quantifying system performance
   Image quality metrics
   Sensitivity
   SNR
   Spectral resolving power
   Error analysis/prediction

Professional skills
   Technical writing
   Technical presentations
   Working as part of a team
   Engineering decision making
   Intellectual property
   Introduction to project management
   Introduction to finance
   Career planning

Special Topics
   Stray light
   Illumination – conservation of etendue
   Infrared systems